

# *Use of Electrosark Deposition for Repair of Navy Components*

March 2005 HCAT Meeting  
Greensboro, NC

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# *Targeted Applications*

- Steering & Diving Control Rods
- Hull Valve Stems
- Alloy 625 Seawater Components

# *Control Rods and Seawater Hull Valve Stems*

- **ISSUE**

Unacceptable corrosion/wear of Alloy K500 control rods and valve stems

- **SOLUTION**

Electrospark deposition of Alloy 400 to re-establish original dimensions

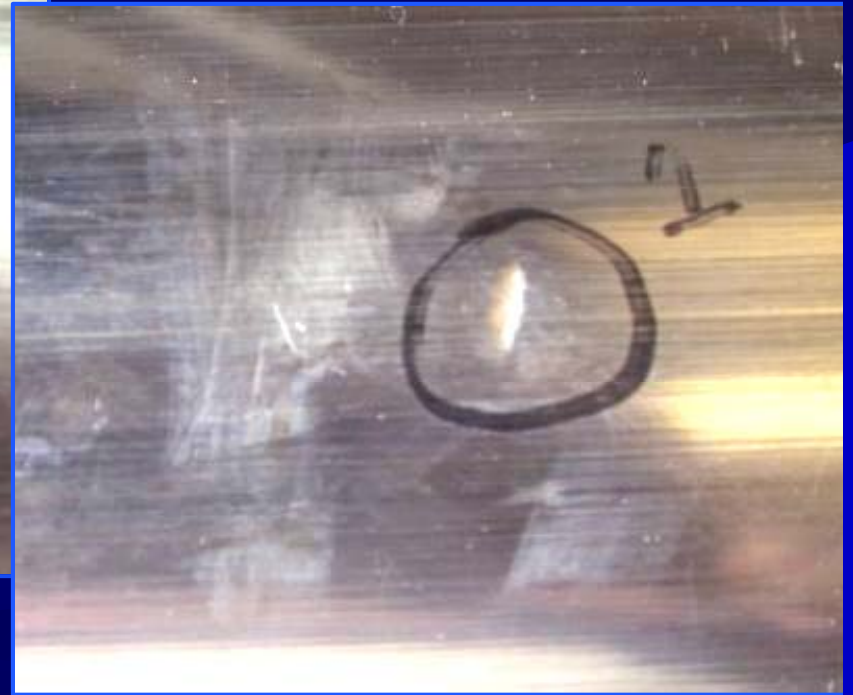
# *Hull Valve Stem*



# *Steering and Diving Control Rod*



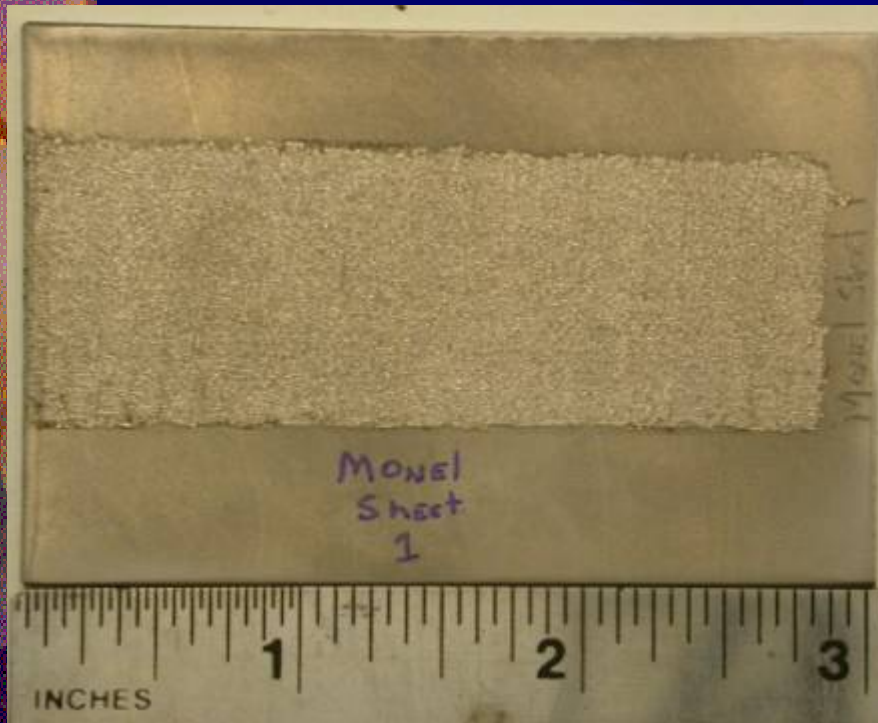
# *Steering and Diving Control Rod*



# *ESD Repair Status Control Rods and Valve Stems*

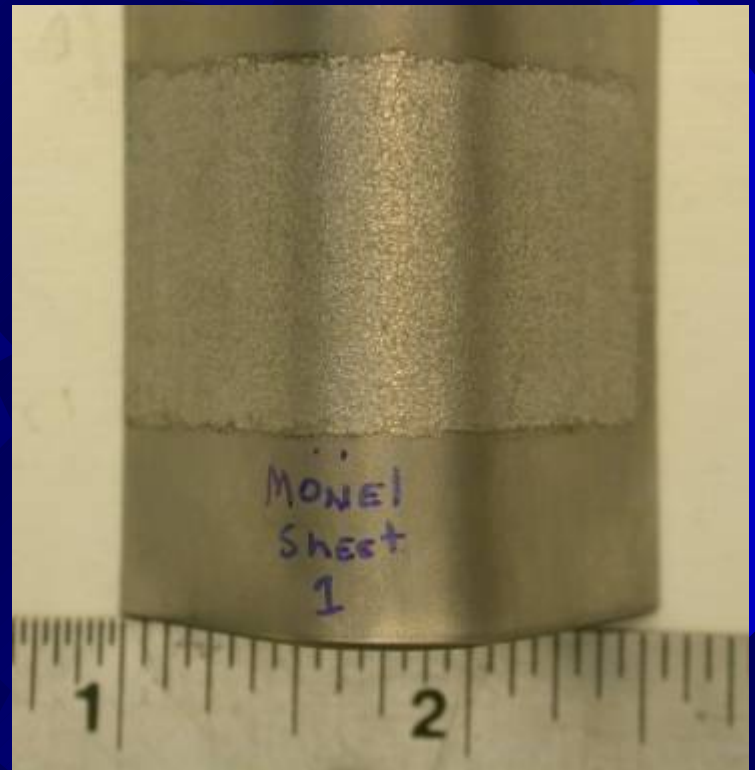
- ✦ Optimized ESD Parameters
  - Metallographic Assessment of Coating Quality
  - Microhardness Measurements
  - Bend Testing

# *ESD Repair Status - Bend Testing*



Before Bend Test

After Bend Test



# *ESD Repair Status Control Rods and Valve Stems*

- ★ Completed Corrosion Evaluation
  - Potentiodynamic Polarization
  - Seawater Immersion
  - GM9540P Accelerated Corrosion Testing
- ★ Developed Draft Process Instruction for Control Rod Repair

# *ESD Control Rod Repair*

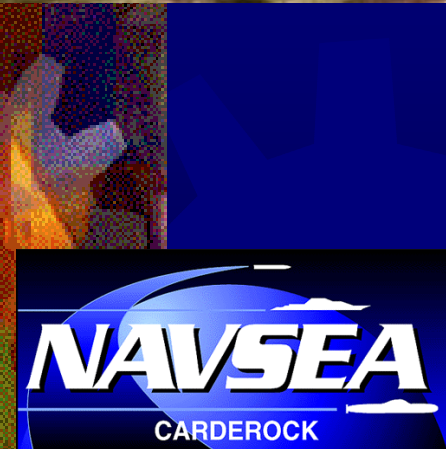
Before Repair



Defect Measured  
0.016" to 0.021" in Depth



After Repair



# *ESD Control Rod Repair*

Before Repair



Defect Measured  
0.012" to 0.017" in Depth



After Repair

# *ESD Control Rod Repair*

Before Repair

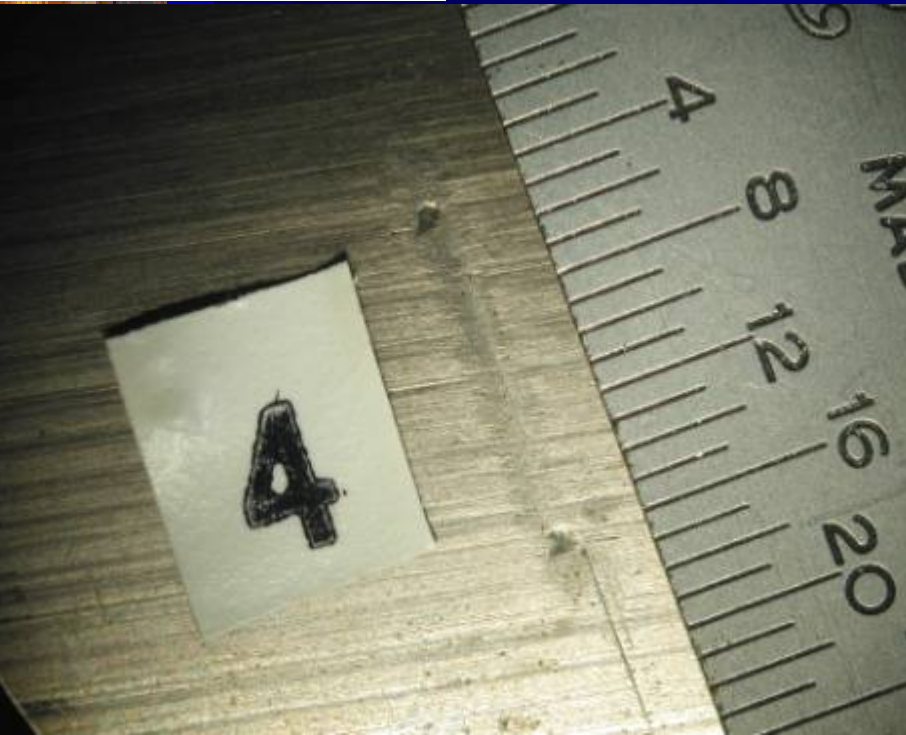
Defect Measured  
0.006" Maximum Depth



After Repair

# *ESD Control Rod Repair*

Before Repair



Defect Measured  
0.003" to 0.013" in Depth



After Repair

# *ESD Control Rod Repair*

## Future Work

- ✦ Metallographic Evaluation
- ✦ Seawater Corrosion Testing
- ✦ Sliding Wear Testing
- ✦ NDE Methods for Evaluating Repair Quality

# *Crevice Corrosion Repair of Alloy 625 Components*

- ★ Develop NSWCCD Capability to Deposit Crevice Corrosion Resistant Ni-Cr-Mo Alloys on 625 Substrates
  - Alloy C276
  - Alloy 59
  - Alloy 686

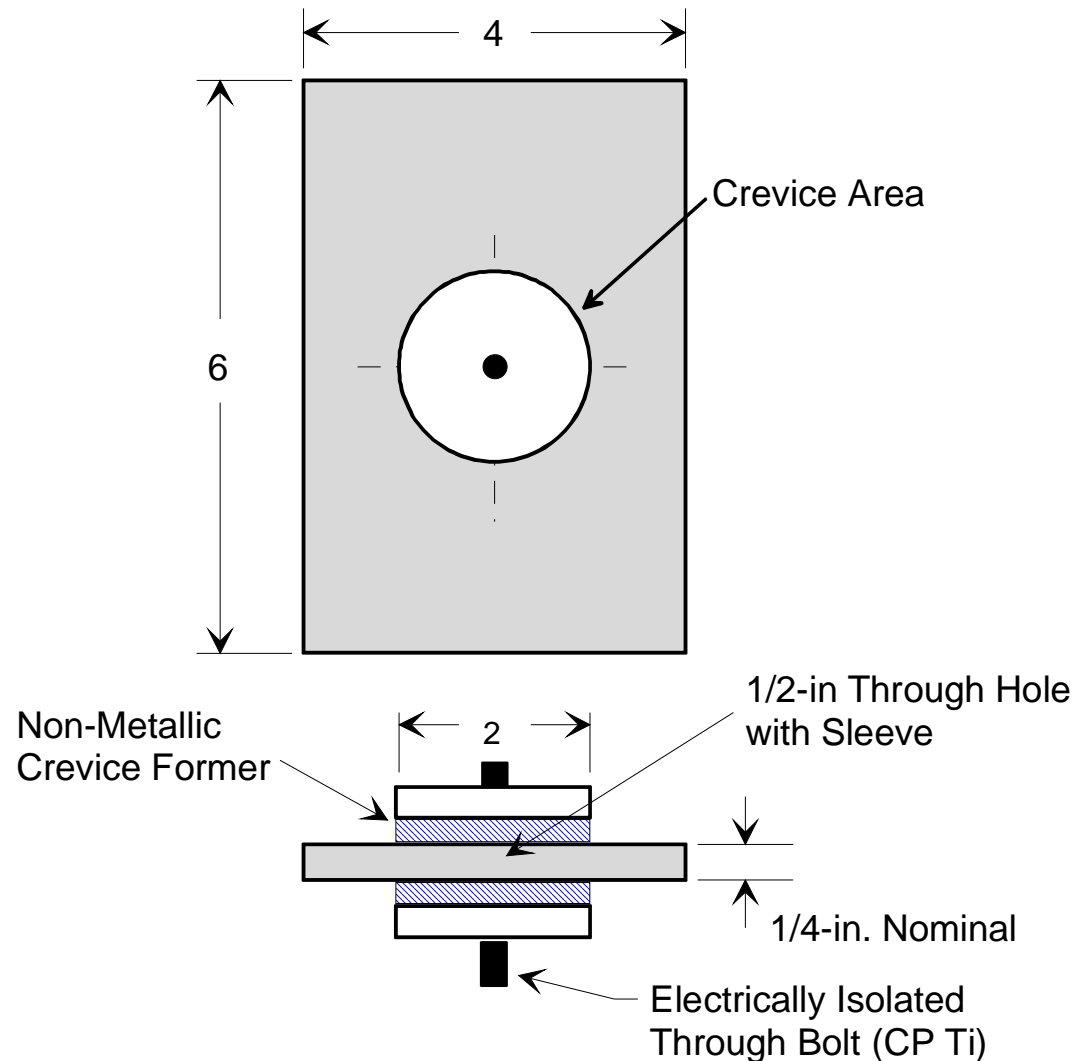
# *ESD of Ni-Cr-Mo Alloys on Alloy 625*

## **Crevice Corrosion Testing**

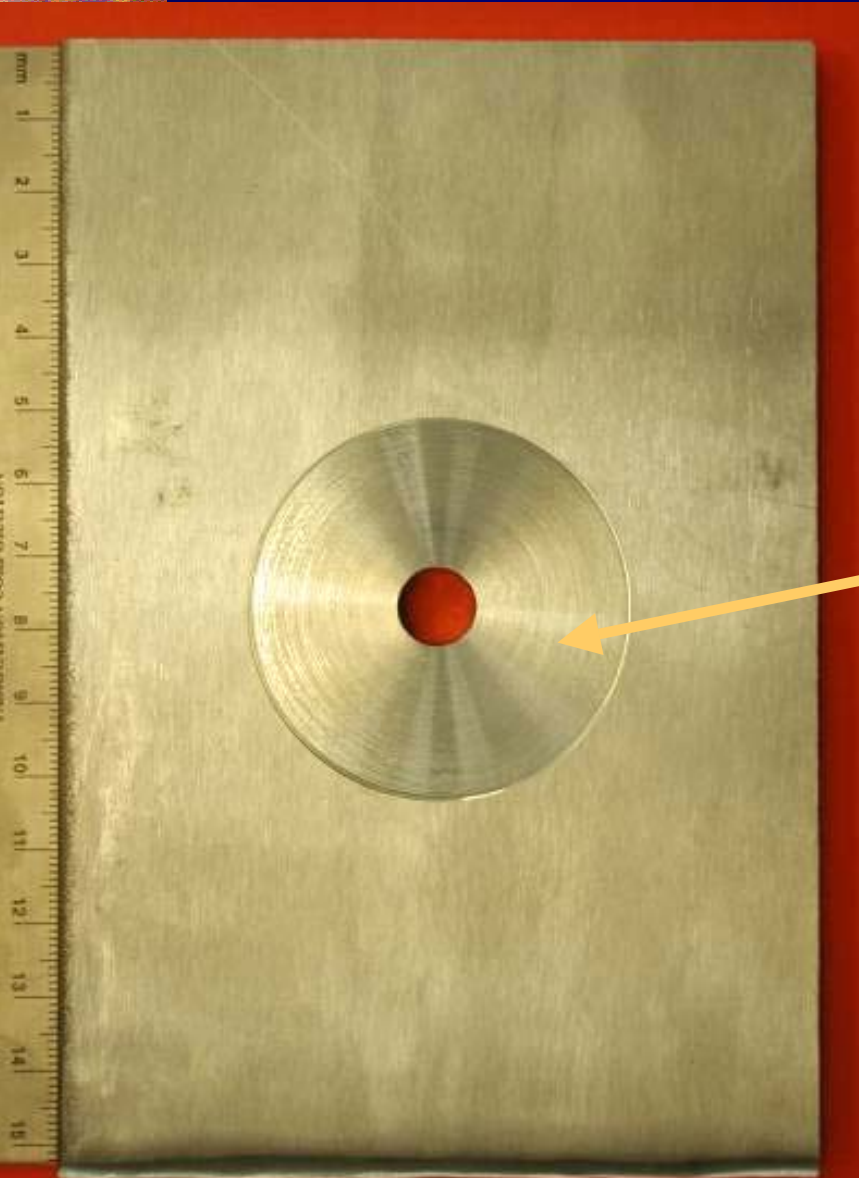
- ESD Coatings of Alloy 686, C276, and 59 Applied on Alloy 625 Panels
- Control Specimens Include Uncoated Alloy 686, C276, 59, and 625
- Triplicate Specimens Exposed per Condition for **180** and **365** Days in Filtered, Natural Seawater Immersion

# *ESD of Ni-Cr-Mo Alloys on Alloy 625*

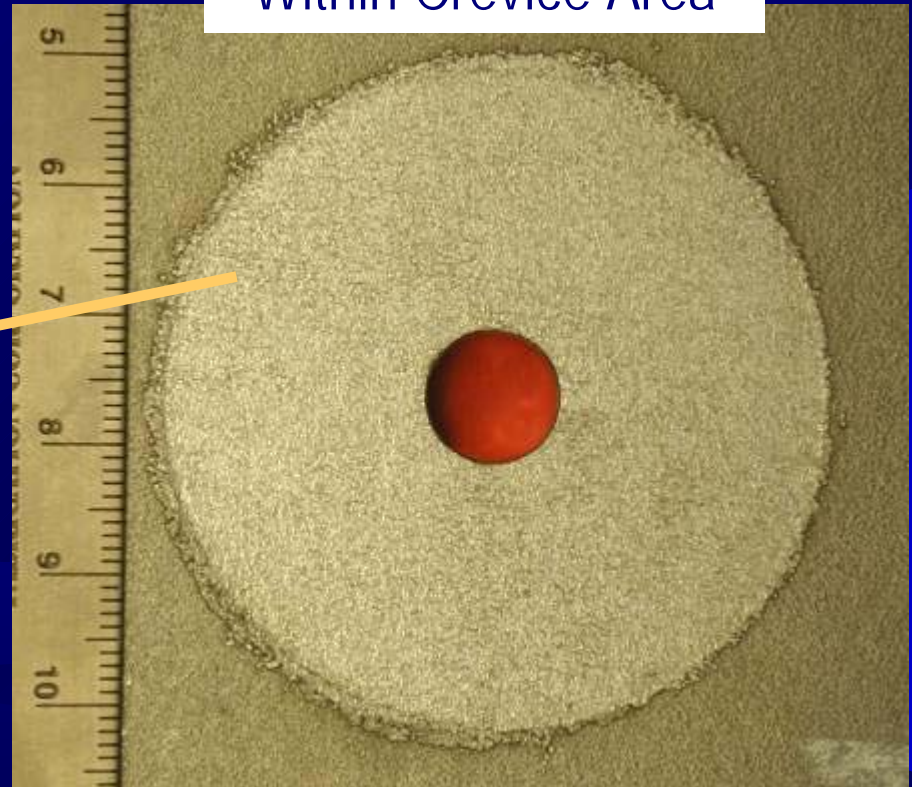
## **Crevice Corrosion Testing in Natural Seawater**



# *ESD of Ni-Cr-Mo Alloys on Alloy 625*



ESD Coating Applied  
Within Crevice Area



# *Crevise Corrosion Testing of ESD Ni-Cr-Mo Alloys on 625*



# *Crevice Corrosion Testing of ESD Ni-Cr-Mo Alloys on 625*

## RESULTS TO DATE

- Crevice Panels in Test for 90 Days
- 5 of 6 Crevice Panels Containing ESD C276 in Crevice Area Show Evidence of Corrosion
- Remaining ESD and Control Panels Appear Corrosion-Resistant